SAN RAFAEL DESERT MASTER LEASING PLAN
APPENDIX C—BEST MANAGEMENT PRACTICES

INTRODUCTION

Best Management Practices (BMPs) are measure applied on a site-specific basis to reduce or eliminate adverse impacts. For each proposed action, a number of BMPs may be applied to mitigate anticipated impacts. BMPs can be voluntarily incorporating by project proponents into individual proposals as design features, or added by the Bureau of Land Management (BLM) to authorizations as conditions of approval.

BMPs should be selected based on the site specific requirements of the project and local environment. No one management practice is best suited to every site or situation. BMPs must be adaptive and monitored regularly to evaluate effectiveness. BMPs by their very nature are dynamic innovations and must be flexible enough to respond to new data, field research, technological advances, and market conditions.

The BLM continues to improve the way it manages oil and gas development on public lands. Part of that improvement includes the use of BMPs to lessen the effects of oil and gas development on the environment. The oil and gas industry and the BLM are constantly developing and improving BMPs.

The BMPs listed below may be applied to proposed oil and gas activities in the San Rafael Desert (SRD) Master Leasing Plan (MLP) area under Alternatives B, C, and D. The list is not comprehensive and may be modified over time as conditions change and new practices are identified. Periodically, the BMPs may be updated to stay current with the latest technology and with the latest Department of Interior and BLM direction.

Construction and Operations

- Well site locations should be planned in order to minimize long-term disruption of the surface resources and existing uses, and to promote successful reclamation.
- Existing roads will be used to the extent possible. All new roads and upgrades of existing roads will be designed to a safe and appropriate standard "no higher than necessary" to accommodate intended vehicular use and to reduce impacts to natural resources.
- No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of four inches deep, the soil shall be deemed too wet to adequately support construction equipment.
- Drainage from disturbed areas will be confined or directed so as to not cause erosion in undisturbed areas.
- Construction of access roads on steep hillsides and near water courses will be avoided where alternate routes provide adequate access.
- Access roads requiring construction with cut and fill will be designed to minimize surface disturbance; and will take into account the character of the landform, natural contours, cut material, depth of cut, where the fill material will be deposited, resource concerns, and visual contrast. Roads will follow the contour of the land where practical.
- Fill material will not be cast over hilltops or into drainages. Cut slope ratios should normally be no steeper than 3:1 and fill slopes no steeper than 2:1.
- Low water-crossings will be used whenever possible.
- Placement of facilities on hilltops and ridgelines will be avoided. Well site layout should take into account the topography and landform. Deep, vertical cuts and steep, long fill slopes should be avoided. All cut and fill slopes should be constructed to the least percent slope practical.

- Trash will be retained in portable trash containers and hauled to an authorized disposal site. Burning of trash will not be allowed on the site.
- Cattleguards will be installed and maintained whenever access roads go through pasture gates or fences. Maintenance includes cleaning out under cattle guard bases when needed.
- All pits and open cellars shall be fenced in accordance with BLM specifications.
- In coordination with the BLM and Emery or Wayne County, operators shall maintain existing roads in a safe, usable condition. Maintenance shall include, but is not limited to, grading, ditching, installing low water crossings, and, if needed, surfacing the road with aggregate.
- Stockpile all brush, limbs, crushed stumps, and other woody material separately from topsoil. Use the stripped vegetation for interim reclamation.
- Repair/replace fences as necessary in order to prevent cattle access to project facilities. Fences will be constructed around reserve pits to prevent wildlife entry.
- Construct a berm of sufficient capacity to contain the storage capacity of the largest tank plus sufficient freeboard to contain 150 percent of the volume of the largest tank to surround the tank battery.
- Apply mat drilling techniques to accelerate and enhance reclamation by decreasing soil and vegetation disturbance, especially in areas where erosive soils are present.
- Locate well pads, associated facilities, and utilities in the least environmentally sensitive areas. Locate wells outside of drainages, below ridgelines, away from important sources of forage, cover, reproductive habitats, winter habitats, parturition areas, and brood-rearing habitats.
- Centralize and combine pipeline systems and other facilities and infrastructure to minimize disturbance during development and production.

Air Quality and Greenhouse Gas/Fugitive Dust

- Water or alternative dust suppressants (i.e. surfactants or other erosion control materials) will be utilized to minimize fugitive dust during construction and applied on material (sand, gravel, soil, minerals, or other matter that may create fugitive dust) piles.
- All vehicles and construction equipment will be properly maintained to minimize exhaust emissions.
- Restrict vehicle speeds to approximately 10 miles per hour (mph) on well pads and production facility locations.
- Vehicles are not to exceed a speed of approximately 20 mph on any unpaved road that does not include a posted speed limit to discourage the generation of fugitive dust.
- Periodic watering or chemical stabilization of unpaved roads.
- Cover, enclose, or stabilize excavated or inactive material piles after activity ceases.
- Use telemetry and well automation to remotely monitor and control production.
- Use centrally stored water that is piped to the well pads through a temporary surface line.
- Centralize (or consolidate) gas processing facilities (separation, dehydration, sweetening, etc.).
- Construction and drilling crews will carpool to and from the site to minimize vehicle-related emissions.
- To the extent possible, utilize solar power to power well site equipment.
- Install vapor recovery units on all oil and condensate tanks.
- Minimize the period of time between initially disturbing the soil and revegetating or other surface

stabilization. Utilize interim reclamation.

- Minimize the area of disturbed land.
- Prompt revegetation of disturbed lands.
- Enclose, cover, water, or otherwise treat loaded haul trucks to minimize loss of material to wind and spillage.
- Revegetate, mulch, or otherwise stabilize the surface of all disturbed areas adjoining roads.
- Reduce elemental carbon, particularly from diesel fueled engines by utilizing controls such as diesel particulate filters on diesel engines, or using lower emitting engines.
- Opportunities to reduce nitrogen oxides (NOx), particularly from internal combustion engines, should be pursued to control impacts to deposition and visibility in nearby Class 1 areas. This may include the use of lower emitting engines, and/or add on controls (e.g. selective catalytic reduction) where appropriate.
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Cultural Resources

- All persons who are associated with mineral operations will be informed that they will be subject to prosecution for knowingly disturbing archaeological sites or collecting artifacts.
- If any previously unidentified cultural resources or human remains are discovered as a result of mineral operations, activity in the vicinity of the discovery will cease and will be immediately reported to the BLM Field Office. Work may not resume at that location until approved by the BLM Authorized Officer.
- Use visual resource BMP's to avoid, minimize, or mitigate potential adverse effects to historic properties.

Visual Resources/Noise/Night Skies

- Use natural or artificial features, such as topography, vegetation, or an artificial berm to help screen facilities. Design roads and other linear facilities to follow the contour of the land or mimic lines in the vegetation. Avoid a straight roads that will draw the viewer's eye and attention toward production facilities.
- Paint above ground production facilities (pumping units, pipes, compressors, tanks, treaters, etc.) a color that allows the facility to blend into the background. Also, paint all new equipment brought onto the site the same color as approved by the BLM Authorized Officer.
- Semi-gloss paints should be used rather than flat paints; the selected paint color should be one or two shades darker than the background.
- During reclamation, replace soil, brush, rocks, shrub/tree debris, etc., over disturbed earth surfaces, which allows for natural regeneration rather than introducing an unnatural looking grass cover.
- Design well pads so that the edges are irregular and more natural-looking. Straight line edges should be avoided.
- Utilize "liquid gathering systems" to eliminate surface storage tanks and reduce truck trips for removal of liquids.
- Place infrastructure within or near previously disturbed locations. Pipelines and electric lines should be buried in or immediately adjacent to access roads. Surface-laid pipelines, if necessary, should also be located in or immediately adjacent to access roads.

- Minimize noise by using best available technology, such as installation of multi-cylinder pumps, hospital grade sound reducing mufflers, and placement of exhaust systems to direct noise away from sensitive receptors.
- Locate drill pads, roads, and facilities below ridgelines or behind topographic features to minimize auditory effects.
- Limit the use of artificial lighting during nighttime operations to only those that are determined necessary for the safety of operations and personnel.
- Utilize shielding and aiming techniques, as well as limiting the height of light poles to reduce glare and avoid light shining above horizon(s).
- Direct lights downward onto the task area. The bottom surface of the light fixture should be level, or if unable to be fully level, point it as close to straight down as possible, or shield it to avoid light being projected horizontally.
- Use lights only where needed, using light only when needed, and directing all lighting onsite.
- Use motion sensors, timers, or manual switching for areas that require illumination, but are seldom occupied.
- Reduce lamp brightness and select lights that are not broad spectrum or bluish in color.

Soil/Water/Riparian

- Minimize disturbance to natural drainage patterns. Design locations for storm conditions, ensure offsite natural runoff does not wash over site, and use perimeter drainage ditches.
- Divert storm water away from well locations with ditches, berms, or waterbars above the cut slopes to trap well location runoff and sediments on or near the location through the use of sediment fences or water retention ponds.
- Inspect equipment routinely for leaks (diesel fuel, hydraulic fluid, lubricating oil, and coolant) and make any necessary repairs. In the event of soil contamination due to equipment fluid spills, isolate and clean up the spill immediately. Implement soil remediation and bioremediation procedures or excavate to an appropriate container and transport to an approved offsite disposal location.
- During reclamation, apply certified weed free mulch or other suitable materials and crimp or tackify to remain in place to reclaim areas for seed retention.
- In areas of identified biological soil crusts, the top 2 to 5 inches of topsoil, inclusive of the biological soil crusts, shall be carefully stripped and stockpiled separately from all other soil materials
- Organic matter and debris shall be retained in the piles to help sustain biological activity and increase the effectiveness of respreading the crust material. Storage piles shall be shallow to preserve microorganisms and seeds. Respread the soil crust during interim and final reclamation. During reclamation, reestablish mounds on the surface prior to reapplying the biological soil crusts.
- Stabilize topsoil stockpiles by 1) spraying with water to establish crust, and 2) cover with biodegradable product.
- Utilize erosion control structures, such as certified weed free straw bales, silt fences, sediment traps, waterbars, drainage ditches, and sediment ponds to prevent down cutting on slopes, to reduce loss of sediment, and to avoid contamination of runoff into perennial and intermittent streams. These structures will remain in place and will be maintained until stabilization and revegetation are complete.
- Regular monitoring of revegetated and reclaimed areas will be conducted with regular maintenance or reseeding as needed until the BLM determines that the revegetation is successful.
- Topsoil will be segregated and stored separately from subsurface materials to avoid mixing during

construction, storage, and interim and final reclamation. Subsurface materials will never be placed on top of topsoil material at any point in the operation. Stockpiles will be located and protected so that wind and water erosion are minimized and reclamation potential is maximized. Ensure that the topsoil is spread evenly over the reclaimed area.

- Use closed-loop drilling systems in sensitive areas or where there is shallow groundwater.
- Substitute less toxic, yet equally effective products, for conventional drilling products.
- Disposal or emergency pits will be located in cut material rather than fill material.
- If water is encountered during construction of a pit, cease construction and immediately contact BLM.
- Avoid constructing reserve pits in areas of shallow groundwater. To prevent contamination of groundwater and soils, use semi-closed-loop or closed-loop drilling systems or lined pits with impermeable liners.
- Where operations are conducted in the vicinity of public water sources, the operator will work with the public water supplier to identify possible methods to protect water supplies.
- At a minimum, the operator and the BLM will adhere to BLM Instruction Memorandum 2010-055 regarding the Protection of Groundwater in Association with Oil and Gas Leasing, Exploration, and Development or the latest BLM policy or guidance. Areas identified with shallow unconfined aquifers and potential unconsolidated aquifers will require additional mitigation that may include closed loop drilling, no surface pits, offsite location of production storage facilities; a spill prevention, control and countermeasure plan (as specified by the Environmental Protection Agency [EPA]); and a storm water management plan. A water monitoring plan may be required to ensure the effectiveness of mitigation to protect water resources.
- Construct all road and pipeline crossings at right angles to streams to minimize the area of disturbance.
- Locate and construct all structures crossing intermittent and perennial streams and ephemeral drainages such that they do not decrease channel stability or increase water velocity.
- Minimize crossings of streams (intermittent and perennial) with vehicles and heavy machinery.
- As specified by the Authorized Officer, reserve pits and other surface impoundments will be lined with synthetic liners with a minimum thickness of 12 millimeters or other materials, such as bentonite or clay. Decommission by removing all contaminants and liner and dispose of the liners in an approved waste management facility or recycle them. For additional siting and closure guidance, refer to IB No. UT 2013-038.
- Use wind fences, other forms of wind breaks, or other techniques where needed to control wind erosion and prevent downwind (off-site) emissions of fugitive dust.
- Use BLM-approved dust suppressants or other techniques when and where needed to prevent emissions of fugitive dust from development sites and associated unpaved roadways.

Reclamation

- Provide a reclamation plan as part of mineral proposals that includes plans for both interim and final reclamation. Reclamation is required of any disturbed surface that is not necessary for continued production operations. Additional reclamation measures may be required based on existing conditions at the time of final abandonment.
- Operators would be required to following the Green River Reclamation Guidelines for all development in the Price Field Office.
- Planning for reclamation should occur prior to construction in order to achieve successful reclamation in the future. Successful final reclamation is achieved more efficiently by locating

operations in areas that minimize reclamation needs, the sufficient salvage of topsoil, and completion of interim reclamation.

- Reclaimed areas above pipelines receiving incidental disturbance during maintenance activities will be reseeded as soon as practical.
- Final reclamation of all mineral related disturbances will involve recontouring of all disturbed areas, including access roads to the original contour or a contour that blends with the surrounding topography and revegetating all disturbed areas to native species. It also involves salvaging and reusing all available topsoil (whatever soil is on top) in a timely manner, revegetating disturbed areas, controlling erosion, controlling invasive non-native plant and noxious weeds, and monitoring results. Reclamation measures should begin as soon as possible after the disturbance and continue until successful reclamation is achieved.
- The long-term objective of final reclamation is to set the course for eventual ecosystem restoration, including the restoration of the natural vegetation community, hydrology, and wildlife habitats. In most cases, this means returning the land to a condition approximating or equal to that which existed prior to the disturbance.
- During the life of the mineral operation, all disturbed areas not needed for active support of the operation should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses. Reclamation is required of any disturbed surface that is not necessary for continued mineral operations.
- Disturbed areas should be revegetated after the site has been satisfactorily prepared. Site preparation will include respreading topsoil to an adequate depth, and may also include ripping, tilling, disking on contour, and dozer track imprinting.
- Any topsoil pile set aside should be revegetated to prevent it from eroding and to help maintain its biological viability.
- All pits must be reclaimed to a safe and stable condition that blends with the rest of the reclaimed area. If necessary, the pit area should usually be mounded slightly to allow for settling, to allow for positive surface drainage.
- Interim reclamation of the well pad and access road will begin as soon as practical.
- Facilities will be grouped on the pads to allow for maximum interim reclamation. Interim reclamation will include road cuts and fills and will extend to within close proximity of the well head and production facilities.
- Respread topsoil over the entire location and revegetate to within a few feet of the production facilities, unless an all-weather, surfaced, access route or turn-around is needed.
- The well site must be recontoured to original contour or a contour that blends with the surrounding landform, stockpiled topsoil evenly distributed, and the site revegetated. Salvaged topsoil must be respread evenly over the surfaces to be revegetated. The topsoiled site should be prepared to provide a seedbed for reestablishment of desirable vegetation.
- Final reclamation includes recontouring the road back to the original contour, seeding, controlling noxious weeds, and may also include other techniques to improve reclamation success, such as ripping, scarifying, replacing topsoil, constructing waterbars, pitting, mulching, redistributing woody debris, and barricading.
- Use stockpiled brush, limbs, crushed stumps, other woody material, and stripped vegetation for interim and final reclamation.
- Fencing will be installed to prevent livestock from grazing the reclaimed area until vegetation is reestablished.

Vegetation/Noxious Weeds and Invasive Species

- Seeding performed as part of reclamation operations will take place in the fall from mid-October until mid-December when the ground surface is not frozen.
- Prior to commencing operations, all equipment and vehicles will be cleaned to remove seeds and soil that may contain seeds in order to avoid the spread of noxious weeds and invasive species.
- To minimize the potential of spreading weed seeds between drilling locations, compressed air will be used to remove weed seeds and soil from equipment before it is mobilized to the next drilling location.
- Develop a weed management plan on how to monitor growth of invasive species resulting from surface disturbance caused by project activities and how to control noxious weeds and invasive species through the application of commercial herbicides after obtaining a Pesticide Use Permit from the BLM.
- Treatment to prevent the introduction or spread of invasive/noxious plants would conform to the guidelines and principles of the Western States Environmental Impact Statement for vegetation treatments, which specifies herbicides approved for use, treatment protocols, mitigation, and monitoring.
- Construction equipment and vehicles will not be allowed to drive through weed-infested areas.
- In coordination with the BLM and Emery and Wayne Counties, control noxious and invasive plants that become established along roads, on well pads, or adjacent to other facilities.
- Clean and sanitize all equipment brought in from other regions. Use portable washing stations to periodically wash down equipment entering and leaving well field areas, especially during muddy conditions.

Wildlife

- Identify important, sensitive, and unique habitats and wildlife in the area. Incorporate mitigation practices that minimize impacts to these habitats.
- Plan the pattern and rate of development to avoid the most important habitats and generally reduce the extent and severity of impacts.
- Cluster drill pads, roads, and facilities in specific areas that would have a lower impact on wildlife habitat.
- Consider liquid gathering systems to eliminate surface storage tanks and reduce truck trips for removal of liquids.
- Place infrastructure within or near previously disturbed locations in order to avoid new impacts to wildlife habitat.
- Roads would be reclaimed as soon as possible after they are no longer required.
- Personnel will be advised to minimize stopping and exiting their vehicles in big game winter range when there is snow on the ground.
- If it is found that project activities could potentially affect raptor nesting, as determined from decreased raptor productivity or nesting, or documented nest abandonment or failure, alternate nesting sites (ANS) may be constructed at a rate of up to two ANSs for one impacted nest. Existing degraded raptor nests may be upgraded or reinforced to minimize potential impacts.
- In order to minimize potential for raptor mortalities on production facility structures, raptor protection measures shall be applied (e.g., modify for raptor-safe construction, install perches, perching deterrents, nesting platforms, nest deterrent devices, etc.).

- In order to limit impacts to pronghorn antelope, avoid aggressive non-native grasses and shrubs in pronghorn habitat restoration.
- If produced water is allowed to evaporate after completion of drilling, reserve pits will be fenced on four sides to prevent entry by wildlife and/or livestock.
- Promptly report observations of potential wildlife problems to the regional office of the Utah Division of Wildlife Resources (UDWR) and, as applicable, to the U.S. Fish and Wildlife Service (USFWS).
- The operator will notify the BLM Authorized Officer and nearest USFWS Law Enforcement office within 24 hours if the operator discovers a dead or injured Federally protected species (i.e., migratory bird species, bald or golden eagle, or species listed by the USFWS as threatened or endangered) in or adjacent to a pit, trench, tank, exhaust stack, or fence. (If the operator is unable to contact the USFWS Law Enforcement office, the operator must contact the nearest USFWS Ecological Services Office.)
- Design, construct, and maintain exclosure fencing for all open cellars and pits containing freestanding fluids to prevent access to livestock and large forms of wildlife, such as deer, elk, and pronghorn. At a minimum, the operator will adequately fence all fluids pits and open cellars during and after drilling operations until the pit is free of fluids and the operator initiates backfilling. The operator will maintain the fence in order to protect public health and safety, wildlife, and livestock.

  (For examples of exclosure fencing design, refer to the Oil and Gas *Gold Book* – Exclosure Fence Illustrations, Figure 1, Page 18.)

  Adequate fencing (in lieu of more stringent requirements by the surface owner) includes all of the following:

  1. Construction materials will consist of steel and/or wood posts. Use a fence with five separate wires (smooth or barbed) or hog panel (16-foot length by 50-inch height) with connectors, such as fence staples, quick-connect clips, hog rings, hose clamps, twisted wire, etc. Do not use electric fences.
  2. Set posts firmly in the ground. Stretch the wire, if used, tightly and space it evenly, from the ground level to the top wire, effectively keeping out animals. Tie hog panels securely into posts and to one another using fence staples, clamps, etc. Construct the fence at least 2 feet from the edge of the pit.
  3. For reserve pits, fence all four sides as soon as the pit is constructed. Reconstruct any damage to the rig side of the fence immediately following release of the drilling rig.
  4. Maintain the erect fences in adequate condition until the pit has been closed.
- The operator will prevent wildlife and livestock access (including avian wildlife) to fluids pits that contain or have the potential of containing salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, surfactants, or Resource Conservation and Recovery Act-exempt hazardous substances. At a minimum, the operator will install approved netting in these circumstances, in accordance with the requirements below, immediately following release of the drilling rig.

  Note: The BLM generally does not approve of the use of flagging, strobe lights, metal reflectors, or noisemakers as techniques for deterring wildlife.

  Minimum Netting Requirements

  The operator will:

  1. Construct a rigid structure made of steel tubing or wooden posts with cable strung across the pit at no more than 7-foot intervals along the X- and Y-axes to form a grid

of 7-foot squares.

2. Suspend netting a minimum of 4 to 5 feet above the pit surface.
3. Use a maximum netting mesh size of 1½ inches to allow for snow loading while excluding most birds in accordance with U.S. Fish and Wildlife Service recommendations. Refer to: http://www.fws.gov/mountain-prairie/contaminants/contaminants1c.html.
4. Cover the top and sides of the netting support frame with netting and secure the netting at the ground surface around the entire pit to prevent wildlife entry at the netting edges. Note: Hog wire panels or other wire mesh panels or fencing used on the sides of the netting support frame is ineffective in excluding small wildlife and songbirds unless covered by smaller meshed netting.
5. Monitor and maintain the netting sufficiently to ensure the netting is functioning as intended, has not entrapped wildlife, and is free of holes and gaps greater than 1½ inches.

- The operator will construct and maintain pits, cellars, open-top tanks, and trenches, that are not otherwise fenced, screened, or netted, to exclude livestock, wildlife, and humans (for example, lined, clean water pits; well cellars; or utility trenches) to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in pits, cellars, open-top tanks, or at frequent intervals along trenches where entrapment hazards may exist.
- Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock.
- The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable State or U. S. EPA livestock water standards in accordance with State law. The operator must not drain the fluids to the soil or ground.
- The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems, such as fencing, netting, expanded metal mesh, lids, and grate covers.
- The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.